SUMMARY

Introduction: Diagnostic imaging has a crucial role in the diagnosis and therapeutic management of acute ischemic stroke (AIS). The main aim of this thesis was to further evaluate the utilization of CTA and CT perfusion (CTP) in the diagnosis and treatment decision in patients with AIS caused by the occlusion of the middle cerebral artery.

Methods: Study in *Chapter 2* evaluated the automatically derived CT perfusion lesion volumes (PLV) and hypoperfusion intensity ratio (HIR) with collateral score using multiphase CTA (mCTA) (Kruskal-Wallis, Wilcoxon rank-sum test and Spearman's rho correlation coefficients were calculated). In study in *Chapter 3*, the assessment of ischemic changes by expert reading and available automated software for non-contrast CT and CTP was compared (the sensitivity, specificity, positive and negative predictive value were calculated). In *Chapter 4,* the performance of Stroke*SENS* software tool in detection of anterior large vessel occlusions (LVO) was tested (receiver operator characteristics analysis). Study in *Chapter 5* investigated whether prediction of clinical outcome and final infarct volume can be improved by collateral status assessment on time-variant color-coded mCTA (multivariable logistic regression). The aims in *Chapter 6* were to determine if mCTA-derived tissue maps can detect medium vessel occlusions (MeVO), and predict follow-up infarct (sensitivity, specificity, and AUC were calculated for MeVO detection, concordance correlation coefficient and intraclass correlation coefficient for volumetric and spatial agreement between predicted infarcts on mCTA and CTP).

Results: In *Chapter 2*, we demonstrated mCTA collateral score corresponds with automatically-derived PLV with significant difference between good and poor collaterals. High accuracy for the assessment of ischemic changes by different CT modalities was demonstrated in *Chapter 3*. We showed in *Chapter 4* Stroke*SENS* LVO detected anterior LVO with high accuracy. *Chapter 5* demonstrated that collateral extent assessment on time-variant mCTA improved prediction of outcome and was comparable to conventional mCTA in predicting follow-up infarct volume. Study in *Chapter 6* showed mCTA tissue maps are reliable in MeVO detection and tissue fate prediction.

Conclusion: The correlation of mCTA collateral status and CTP-derived PLV suggests that PLV can be estimated by collateral grade in AIS patients. High accuracy of early ischemic changes assessment using automated software analysis encourages its use in clinical practice. The reliable performance of the software tool in anterior LVO detection further supports the use of machine learning based software tools in acute care to identify patients who can benefit from timely treatment. Time-variant mCTA is a suitable alternative to interpretate the collateral status. mCTA-derived tissue maps can be used to detect MeVO and estimate the volume of potentially salvageable tissue.

Key words: acute ischemic stroke, stroke imaging, multiphase CTA, CT perfusion, automatic software analysis, collateral score